



## Land series

# Vetiver grass for soil and water conservation

Vetiver grass, or khus khus (*Vetiveria zizanioides L.*), is native to South and South-East Asia, where it has been used for centuries to mark boundary lines. Its roots and tops have also been harvested. The fragrant, insect-repelling roots yield an oil which is valuable in the perfume industry.

Traditionally, these roots were woven into mats, fans and fragrant screens, while the tops of the grass were used for handicraft, thatch, mulch, fodder and animal bedding. Vetiver is still cultivated for these purposes today in South and South-East Asia, Africa, the Pacific, the Americas and the Caribbean.

In the last 50 years, attention has been focussed on vetiver's unique soil conservation properties. When planted in single lines along the contour, hedges of vetiver grass are found to be very effective in soil and moisture conservation. The stiff stems of the thick hedge slow the movement of runoff water and spread it out, trapping silt behind the hedge, (see Figure 1). This allows more water to be absorbed into the soil, thus reducing runoff and erosion.

Vetiver is non-invasive, has no runners nor rhizomes, and only spreads by tillering. Vetiver is being widely used for steep slope stabilisation and rehabilitation of degraded and disturbed lands in many places including the Caribbean, Fiji, India, Africa, Malaysia and Thailand. Other related grasses, namely lemon grass and citronella grass, have also been used less successfully as vegetative erosion hedges. The success of vetiver is due to its special characteristics as described below.

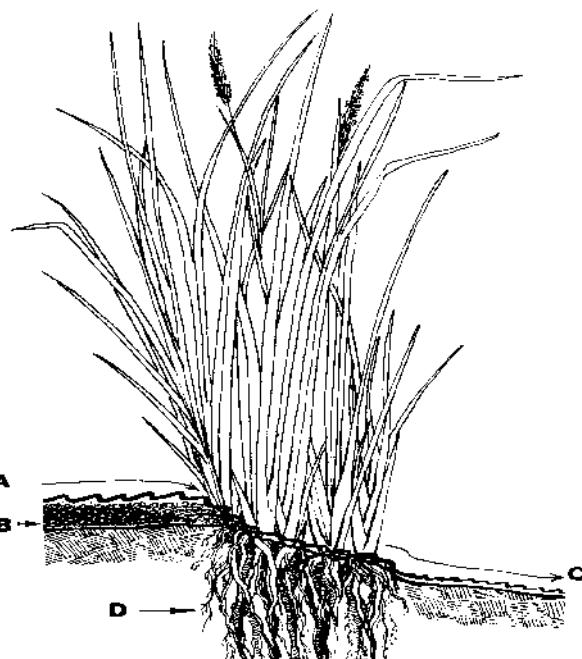
## Growing conditions

Vetiver is adaptable to a wide range of soil and climatic conditions. It can be established on very acid, sodic, alkaline, or saline soils. Vetiver also tolerates very high levels of aluminium, manganese, and a range of heavy metals in the soil.

Due to its extensive and deep root system, vetiver is very tolerant to drought. It can stand extreme heat (50°C), and frost (-10°C), and can be established in

areas with an annual rainfall greater than 450 to 500 mm.

Vetiver can withstand burning, slashing, and moderate tractor traffic. It is quite resistant to fire when green, and resists infestation from most pests, diseases, and nematodes. Vetiver is very sensitive to shade as this severely retards growth, especially in young plants.



**Fig. 1 Sketch of a vetiver plant**

A	silt-loaded runoff being slowed down by the plant
B	silt dropping out of the water behind the plant
C	sediment free water continuing on down the slope
D	dense spongy root system that binds the soil together to a depth up to 3m

## Queensland applications

Extensive research and field trials on the adaptability and application of vetiver have been conducted throughout Queensland since 1989.

Under Queensland conditions, vetiver has been successfully used for:

- gully stabilisation
- waterway and drainage channel stabilisation
- steep batter stabilisation
- improving water quality by filtration of sediment from runoff water that may be carrying nutrients and chemicals
- filtration of sediment from runoff water.
- reduction of flood damage in strip cropping layouts
- rehabilitation of contaminated sites such as old rubbish dumps
- rehabilitation of old quarries, and degraded and disturbed lands
- spreading and diverting of runoff water
- rehabilitation and control of erosion on acid sulfate soils
- rehabilitation of mine spoils and tailings
- disposal of effluent and waste water from domestic and industrial sources.

## Weed potential

To reduce its weed potential, a sterile cultivar was selected from a number of vetiver cultivars available in Australia. Registered as Monto vetiver, its release has been approved by the Environment Protection Authority.

Although Monto vetiver flowers under certain conditions, it sets no viable seed and its sterility was rigorously tested under climatic conditions ranging from the wet tropics of north Queensland to the temperate region of Victoria. Other varieties available in Australia do set viable seed and therefore should not be used.

Vetiver grass has been an introduced species in many tropical countries for over 100 years. It has been grown in good and poor soils, on dry and swampy lands, and has never become a weed. In Fiji, where vetiver hedges have been used extensively for 50 years, farmers and agriculturists know of no incidence where it has spread of its own accord. Once established, vetiver plants stay where they are planted.

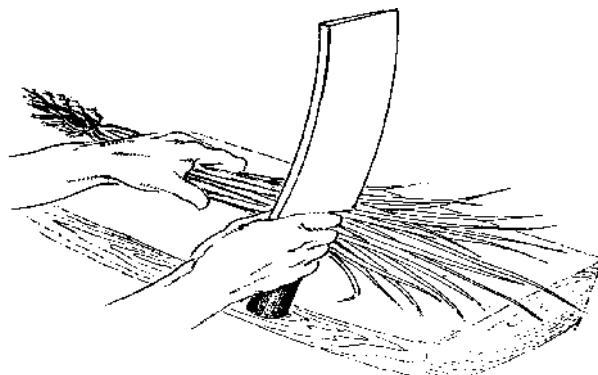
Though plants and hedges are long-lasting, with some plants known to be 60 years old, they can be removed with little effort. It is sufficient to simply remove the crown with a shovel or plough blade or

treat it with glyphosate herbicide, to which vetiver is very sensitive.

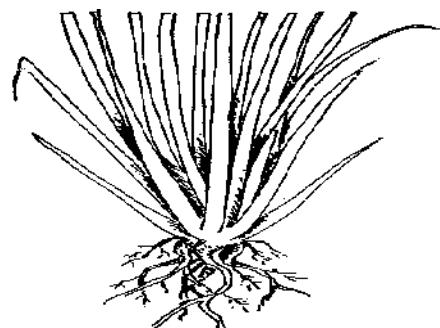
## Propagation

Although vetiver can be planted as bare root slips by splitting up older plants, a better establishment rate is obtained by raising young plants first.

- Break up young pre-flowering vetiver plants into planting slips of two to three tillers (for best results the tillers should be well rooted and contain at least one stem).
- Cut back the tops of the vetiver slips to 200 mm length, and the roots to 50 mm (see Figure 2).
- Plant each slip in a small tube or pot of approximately 50-60 mm diameter and 100 mm depth. The potting medium should be a well-drained sandy loam, free of weed.
- Fertilise by sprinkling each pot with approximately 5 g of DAP (di-ammonium phosphate).
- Water the pots daily and allow them to grow for a period of approximately 3 weeks in summer and 5 weeks in winter, prior to planting.
- Plant in a full sun position if possible
- Vetiver is ready for planting when at least two new shoots appear (Figure 3).



**Fig. 2 Cutting the vetiver strip prior to planting**



**Fig. 3 A vetiver slip ready for planting**

Another propagation method is to establish the slips first in a sand bed of approximately 150-200 mm depth. When ready for planting, vetiver plants are removed from the sand bed exposing their newly established roots.

The advantage of this method is that the vetiver slips can be established in the sand pit faster, and at a higher density than potting, and there is less weight to transport to the planting sites. A disadvantage of this method is that the exposed roots should be planted into wet soil and kept moist during the first few days.

Planting materials can also be obtained by splitting up older plants. Bare root planting costs less than other methods of propagation, but is restricted to the following conditions:

- Slips are best planted within 24-48 hours of being dug up
- A slightly larger slip size (at least three tillers) should be used
- Slips should be planted in wet soil or irrigated well immediately after planting.

## Ground preparation

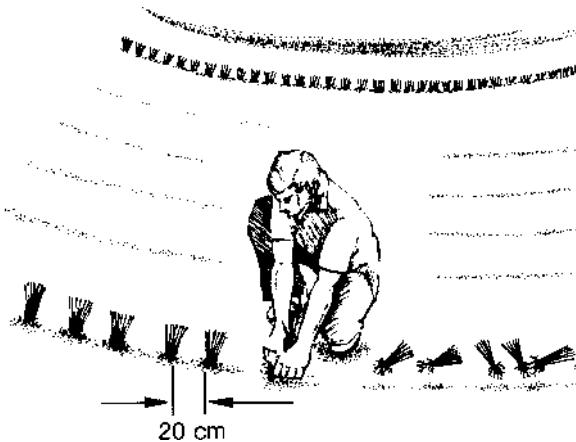
Weeds compete with the vetiver seedlings for moisture and nutrients and can shade the seedlings out. To eliminate weed competition, the planting area should be first sprayed and then either ripped or cultivated.

Vetiver is very sensitive to glyphosate, but 2,4-D or a pre-emergent spray such as atrazine can be used after planting.

## Planting

- Use a level to ensure accurate planting on the contour (see Figure 4)
- Plant into wet soil or irrigate well immediately after planting
- Plant well-rooted slips or bare root plants 150 mm apart to ensure a close hedge during its first year
- Cover vetiver roots with 20-30 mm of soil and compact the soil firmly
- Fertilise with nitrogen and phosphorus such as DAP (di-ammonium phosphate) at the rate of about 50 g per metre length
- Water every second day until the plant is established. After establishment, water twice weekly if there is no rain for 3-4 weeks.
- Control weeds around the hedge until the plants are established
- Avoid planting during the hottest part of the year

- In southern Queensland avoid planting from April to September when the risk of frost is high (well established plants can survive severe frost)
- For central and northern Queensland, vetiver can be planted throughout the year provided watering is carried out during the dry months.



**Fig. 4 Planting vetiver on the contour**

Be generous in caring for the plants during the establishment phase. After approximately 18 months to 2 years, a strong permanent hedge will have formed. A line of vetiver plants cannot function as an erosion control barrier until the individual plants have grown together and closed up into a hedge. Trimming the young plants stimulates early tillering and the hedge will close up faster. The mature hedge requires no further fertilising or watering.

## Maintenance

A vetiver hedge should be considered a living barrier which requires some maintenance, but once fully established only minimal maintenance is needed. In very poor soil conditions such as gullies and eroded areas, fertiliser is needed twice a year-once early and once late in summer-for the first few years.

Due to vetiver's sensitivity to shading, control of broad leaf weeds is required during the first year, and climbing weeds during subsequent years.

To promote spreading, the hedge should be topped to a height of 500 mm every year at the end of winter. Under good growing conditions, hedges may need to be trimmed every 3-4 years (by deep ripping the upper edge of the vetiver contour), to keep their width between 0.3 and 0.5 metres. If this is done, the hedge will not take up too much land, farm machinery can be driven across it and it will not harbour vermin.

Young plants are palatable to sheep, cattle, and particularly horses, therefore the hedge should be protected from these animals for at least the first two summers.

## Important points to remember

- Use a level to ensure accurate planting on the contour
- Only plant well-rooted plants
- Plant into wet soil or irrigate well after planting
- Water every second day until the plant is established
- After establishment water twice weekly if there is no rain for at least 3-4 weeks
- Fertilise with nitrogen and phosphorus (such as DAP) at the rate of 50 g per metre length
- Avoid planting during the hottest part of the year
- Control weeds around the hedge until established. Vetiver is very sensitive to glyphosate, but 2,4-D or other pre-emergent sprays such as atrazine can be used after planting.

## Further information

Department of Natural Resources and Mines staff with specialist experience in the use of vetiver grass are located at the following centres.

### **North region**

Frank Mason	Mackay	07-4967 0873
Darryl Evans	South Johnstone	07-4064 1139
Jim Klein	Mareeba	07-4048 4719

### **South West region**

Clive Knowles Jackson	Toowoomba	07-4688 1168
Peter Pearce	Warwick	07-4661 0230

### **South East region**

Paul Truong	Brisbane	07-3896-9304
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